Employing Computer-Administered Exams in General Psychology: Student Anxiety and Expectations

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Computer-administered exams offer many advantages, but instructors may be reluctant to use them due to concerns that computer anxiety may increase student test anxiety. Introductory psychology students (N = 265) completed surveys prior to their first exam about their anxiety related to the upcoming exam, computers in general, and taking exams on the computer. One group of students took traditional paper-and-pencil exams and the other group took computer-administered exams. We found no differences between the groups for exam anxiety or general computer anxiety, but the traditional group reported more anxiety about taking an exam on computer. We recommend strategies for relieving students' anxiety, such as in-class demonstrations of the technology.

Many introductory psychology textbooks offer online testing as part of the instructor's resources. Testing online offers several advantages to both students and instructors. Students receive quick feedback on their exam score and often which questions they answered correctly. Instructors spend less time grading, and eliminating photocopying saves money.

However, online testing has its disadvantages. New technology invites new ways for students to cheat; therefore security concerns must be addressed by the testing program. Some instructors may be unwilling to invest the time needed to learn a new technology. Finally, computer testing may cause students increased anxiety, above the normal amounts of test anxiety. Our study addressed this last concern by surveying introductory psychology students preparing to take their first exam for both test anxiety and computer anxiety.

Test Anxiety

Test anxiety is concern about negative evaluation that students experience before and during a test. The anxiety may take the form of worry—unwanted, negative thoughts about one's performance, or emotionality—physiological symptoms such as increased heart rate and sweaty palms (Hembree, 1988; Powers, 2001). Hembree's meta-analysis of 562 studies found negative correlations between test anxiety and IQ, GPA, course grades, and achievement scores in reading, math, natural sciences, and other subjects. Hembree concluded that test anxiety is not only related to poor performance, but is the cause of it because interventions that lowered test anxiety resulted in higher achievement. Furthermore, women reported more test anxiety than men, although their performance levels were the same.

Computer Anxiety

Chua, Chen, and Wong (1999) defined computer anxiety as a fear experienced when using a computer or thinking about using a computer. Their meta-analysis of studies published since 1990 showed that computer experience was negatively related to computer anxiety. However, more recent research suggests that undergraduates' familiarity with and access to computers are not related to computer anxiety (McIlroy, Bunting, Tierney, & Gordon, 2001). Yet, students who had a positive initial experience in computing were less anxious than those who had a negative first experience, and students taught by a confident and competent computer instructor (as perceived by the students) had more positive attitudes toward computers than students whose instructors lacked these qualities.

Testing on Computers

The relation of test anxiety to computer testing is not clear, with some research reporting that computer anxiety was negatively related to test performance (e.g., Johnson & Johnson, 1981), and other research finding no relation between computer anxiety, type of test—either computer or paper-and-pencil—and performance (e.g., Wise, Barnes, Harvey, & Plake, 1989). Vispoel, Rocklin, and Wang (1994) found that students generally preferred computerized testing to paper-and-pencil formats, but disliked tests that did not allow for item skipping or review.

We examined undergraduates' self-reports about test and computer anxiety when faced with one of two testing situations—a traditional paper-and-pencil multiple-choice test or a computer-administered test. Before the first exam, we surveyed general psychology students about their anxiety toward the upcoming test, computers in general, and taking tests on a computer.

Method

Participants

A total of 265 students participated. Students received course credit for their participation. Two sections of introductory psychology (163 students; 53 men, 110 women)

taught by two different instructors used computerized testing procedures. Instructors administered the computer exams during the scheduled class time in campus computer laboratories with the instructor or an assistant present. The computer group included 104 freshmen, 38 sophomores, 16 juniors, and 5 seniors. Two sections of introductory psychology (102 students; 47 men, 55 women) taught by different instructors used traditional paper-and-pencil exams scored by machine. The traditional group included 67 freshmen, 23 sophomores, 8 juniors, and 4 seniors. The two groups were similar in age (computer: $M = 21.01$, $SD = 4.45$; traditional: $M = 21.46$, $SD = 5.15$). We did not inform the students of the format of the exams before they enrolled in their section of the course.

Instrument

We adapted the State Anxiety in Computing Situations portion of the Computer Anxiety and Learning Measure (CALM; McInerney, Marsh, & McInerney, 1999) for this study. The State Anxiety subscale consists of 20 items, which represent four factors: worry, happiness, physiological symptoms, and distractibility. We presented these items in three *yes–no* checklists. The students indicated which feelings (e.g., worried, threatened, comfortable) or symptoms (e.g., dry mouth, sweaty palms) they had in relation to three situations: the upcoming exam, computer use in general, and taking the exam on a computer. The traditional group imagined that they would take the exam on the computer for the last list.

Procedure

We distributed the surveys during a regular class meeting 1 week before the first exam. All of the exams were multiple-choice. Approximately 90% of the students chose to participate. Prior to the survey, we told all of the students in which format (computer or paper and pencil) their exams would be administered.

Results

We tabulated anxiety scores by adding the number of *yes* responses for the worry, physiological symptoms, and distractibility items and the number of *no* responses for the happiness items (range = 0 to 20) for each of the situation checklists. A 2 (group: computer or traditional) × 2 (male or female) × 3 (situation: exam, computer, exam on computer) repeated-measures ANOVA on the anxiety scores found several significant effects ($p < .05$). The significant Group × Situation interaction answered the question of whether taking the test on computer was related to greater anxiety than the traditional test administration, $F(2, 522) = 8.41$, $p < .001$, partial $\eta^2 = .031$. Post hoc Tukey tests found that the thought of taking the test on computer was more anxiety provoking for the traditional group ($M = 7.10$, $SD = 5.34$) than for the computer group ($M = 5.45$, $SD = 5.08$), $p < .01$. There were no differences between the groups on anxiety toward the exam itself or toward computers in general (see Table 1 for means). For the computer group, students reported more anxiety for the exam itself than taking the exam on computer, $p < .01$, but the traditional group showed no difference between these situations. For both groups, students reported significantly less anxiety for computers than the exam or taking the exam on a computer, ps $< .01$.

The Sex × Situation interaction was significant as well, $F(2, 522) = 3.75$, $p = .02$, partial $\eta^2 = .014$. Post hoc Tukey tests found that women ($M = 9.09$, $SD = 4.93$) reported more anxiety than men ($M = 6.81$, $SD = 4.97$) about the upcoming exam, $p < .01$. However, there were no sex differences in anxiety regarding computers in general or taking the exam on computer (see Table 2 for means).

As expected from the interactions, there were also significant main effects for situation, $F(2, 522) = 105.91$, $p < .001$, partial $\eta^2 = .289$, and sex, $F(1, 261) = 9.71$, $p = .002$, partial

Table 1. Mean Anxiety Levels for Group × Situation

	Exam		Computers		Exam on Computer	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
Computer	8.55_a	4.97	2.91_b	4.06	5.45_c	5.08
Traditional	7.71_a	5.18	3.81_b	4.41	7.10_a	5.34

Note. Possible scores range from 0 to 20, with 20 representing the highest anxiety. Means in the same row that do not share subscripts differ at $p < .05$ in post hoc Tukey tests.

Table 2. Mean Anxiety Levels for Sex × Situation

	Exam		Computers		Exam on Computer	
Sex	*M*	*SD*	*M*	*SD*	*M*	*SD*
Male	6.81_a	4.97	3.00_b	4.25	5.24_c	5.08
Female	9.09_a	4.93	3.42_b	4.19	6.61_c	5.27

Note. Possible scores range from 0 to 20, with 20 representing the highest anxiety. Means in the same row that do not share subscripts differ at $p < .05$ in post hoc Tukey tests.

$\eta^2 = .036$. Neither the main effect for group nor the Group × Sex × Situation interaction were significant.

Discussion

Our results indicate that, when initially confronted with the thought of computer-administered exams, some students are apprehensive. The traditional group reported more anxiety about the thought of computer testing than those students who actually took the tests on computers. The traditional group was no more anxious than the computer group about the exam or computers in general—the anxiety related specifically to the format of the exam. The computer group knew the format of their exams from the first day of class, whereas it is possible many students in the traditional group never considered their feelings toward taking their psychology exams on computer until they completed the survey. The extra time the computer group had to become accustomed to the idea of computer testing may account for their lower levels of anxiety toward computer exams compared to the exam itself or compared to the traditional group's level of anxiety towards computer exams. Our results also support the sex differences in test anxiety found by Hembree (1988) and the lack of sex differences in computer anxiety found by Chua et al. (1999).

The apprehension of both groups toward computer testing may be due to the unfamiliarity of the task and past test-taking experience. General psychology often represents one of students' first college classes, and the likelihood that this is the first course to have computer-administered exams may add to the doubts and fears of beginning college work. On the other hand, as computers become an integrated part of the world and classroom, students may come to accept computer exams as an extension of the larger changes in their world. The routine administration of some standardized exams such as the SAT and the GRE on computers may hasten such acceptance.

Students' initial experiences in computing situations are important for reducing anxiety (McIlroy et al., 2001). Instructors who plan to use computer-administered exams should be aware of the potential for anxiety, doubts, fears, and concerns among their students and should attempt to alleviate them prior to the first exam by such measures as general discussion of the issues or demonstrations and hands-on trial experience with computer-administered exams (e.g., showing projected demonstrations of a hypothetical exam experience, placing practice exams on the computer). Instructors may also permit those students with high levels of anxiety to opt for paper-and-pencil exams when feasible. Such students may later feel confident enough to take computer-administered exams as they observe their fellow students successfully completing computerized exams (we prefer to have such students take the exam in the same computer laboratory at the same time as those who take the exam by computer).

However, further study of computer testing is warranted. For example, a study of not only anxiety measures but test results over the course of the class may determine whether student performance is different with computer-administered as compared to traditional examination methods. We did not consider student performance in this study because of the lack of consistency inherent in comparing four different instructors using four different exams. Information about students' prior experiences with computerized exams might also be examined, particularly as the use of computers in education increases not only at the college level, but also at the secondary education level.

Computers provide a potentially positive match to budget and personnel constraints that many universities face. Particularly in the case of large sections of courses such as general psychology, the use of computer-administered exams seems a viable solution to some of these practical problems. Provided that possible initial student anxiety is confronted, there are benefits for the university, faculty, and students with the use of computer-administered exams.

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Note

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